Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra, India

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"A COMPREHENSIVE STUDY OF EARTHWORM IN MARATHWADA REGION AND EFFECT OF PESTICIDES ON THEIR HABITAT"

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In the Subject **Zoology** faculty of **Science**

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“A comprehensive study of earthworms in Marathwada region and effect of pesticides on their habitats”

1. Introduction:

Earthworm is a soil dwelling terrestrial invertebrate animal and it is belongs to the phylum Annelida, class clitellita and order Ophisthophora. The class clitellates are found about 8000 species they do not have parapodia. Head have less development and they occur worldwide. The clitellata characterized by having a clitellum-the collar that forms a reproductive cocoon during part of their life cycle. Body consists of thick cylindrical muscular tube and body is divided into segmented. Externally segmented with ring on their body internally segmented usually has setae on all segments. Most of earthworms photosensitive they don’t have eyes but specialized photosensitive cell are presented in body. Length of adult earthworm depending on the species it measures about 10mm long and 1 mm wide to 3m long and over 25 mm wide but typically *Lumbricus terrestrils* grows about 360 mm long (*Blakemore, 2012*) probably longest worm records is *Amynthas mekongianus* 3 m long in the mud of bank Mekong river in southeast Asia (*Blakemore et. al., 2007*)

The digestive tract of the earthworm is a straight tube start from mouth to anus. It’s differentiated into alimentary canal and glands. Alimentary canal consists of mouth, bucal cavity, Pharynx, esophagus, crop, gizzards and intestine and glands are embedded in the wall of the alimentary canal (*Edwards’s et.al. 1996*). They depends a wide variety of organic matter includes plant, protozoan, rotifer, nematodes, bacteria, fungi and microorganisms (Omodeo, 2000). Earthworm has no special respiratory organ. Respiration carried out by skin, it has double transport system made of Coelom fluid and simple closed circulatory system. Oxygen carried by hemoglobin present in the blood plasma and released carbon dioxide. The nervous System has a central and peripheral nervous system. CNS consists of two ganglions above the mouth, one on either side, connected to a nerve running along its length to motor nerve and sensory cells in each segment. Large numbers of chemoreceptors accumulates near its mouth (Khaldoon, et. al., 2022). Earthworms

are hermaphrodites and each caries male female reproductive organs and also have separate genital pores. Mating occurs on the surface mostly take place at night, they will exchange sperm and egg each other's and fertilize. The sexual organs are present in segment 9 to 15. They have one or two pairs of testis contained within sac. The two or four pairs of seminal vesicles produce, store and release the sperm via the male genital pores. Ovaries and oviducts in segment 13 release eggs from female genital pores on segment 14, while sperm is expelled from segment 15. They lack a true skeleton but they maintain their structure with hydrostatic skeleton form by fluid filled coelom chambers.

In the world of taxonomy, the stable 'classical system' of Michelson (1900) and Stephenson (1930) was gradually eroded by consideration over how to classify earthworms, and Fender and McKee-Fender (1990) went so far as to state, "The family-level classification of megascolecid earthworms is still confused. (*Fender 1990*) many Scientist have developed own classification system for earthworms, which bring about to confusion and these system have been still continue to be revised and updated. Blakemore (2000) is a modern reversion to the classical system that is historically proven and widely accepted (*Blakemore 2006*). Earthworms are classified mainly in three Eco physiological categories first category epigeic (None burrowing), second (Burrow in soil and casting) endogeic and third category anecic (reaching up). The population of earthworms depends on the physical and chemical properties of the soil such as temperature, moisture, pH, salt aeration and texture as well as available food and reproductive ability of species. Various earthworm species are used to produce vermicomposting by vermi culture, which decomposes organic waste as food converted into organic fertilizers. Organic fertilizers used for agriculture to get more yields, that's why earthworms called farmer's friends. Therefore research topic socially benefited to farmers and society.

2. Review literature:

Earthworm is an invertebrate animal of soil. They play a dynamic role conserve of biodiversity and ecosystem. It is degrading the organic matters into value substances. It is found mainly in moist and humus-rich soils. Earthworms are a major component of soil and these earthworms have been actively plowing the soil for millions of years and help to recycle organic nutrients for plant growth. So, conservation of earthworm population is precise crucial to maintain the soil ecology as well as soil health. They must live in moist soil containing organic matter. The distribution of earthworm observed in undisturbed soil (Frazao et al., 2017).

International Status:

The presence of earthworm in soil is important and significant because they performs different role in aerating and enriching soil (Baskin, 2005; Colemon et al., 2004). Different studies in varied times showed its role in ecosystem building (Dash and Patra, 1977, Fragosco and Lavelle, 1992). They are specific bio-indicator which can change the soil quality (Paoletti, 1999), fertility by fragmentation and amalgamation of soil with the minerals which promotes microbial population in soil and enhances in the process of breakdown of organic matters, when these organic matters are reached to the gut of the earthworms and converts as cast, these are enrich with nutrients (Stephenson, 1993). Soil texture depends on activity and distribution of earthworm (Yvan, et al., 2016). The distribution of large number of earthworm in soil is very important because they are involved in soil formation (Goats and Edwards, 1988). In the temperate and tropical soil earthworm diversity dominates the biomass of invertebrates (Rai, 2017).

In the litter lots of carbon and nitrogen are deposited, these inorganic molecules are very much important for earth-worms, earthworms obtains these inorganic molecules from litter by decomposing process, So, C:N ratio indicates the distribution of earthworms in a particular region of the soil(Edwards and Bohlen, 1996). Distribution of earthworms is irregular according to type of soil (Curry,

1998) Earthworm is important organism plays a role in agro-ecosystem because they considerably influence physical structure of soil, and promotes plant growth (Julka, 1993). Earthworm has valuable effects on the physical and biological and chemical properties of soil

National Status:

The earthworm fauna of India is well documented compared to other Asian countries some points regarding status of earthworm in India. A total of 513 different location (Rural, urban and sub-urban localities) covering both arid and semiarid areas were surveyed. Eleven earthworm species were recorder belonging to five different families notable species include *Perionyx sansibaricus, Amynthas morrisi and Metaphire posthuma*. These earthworms distributed and species richness pattern were directly related to local microclimatic factors and human activity. (Bano, 1991)

Presently, 452 valid species of earthworm under 71 genera are known from the Indian territory, including the island of andaman,nicobar and Lakshadweep. The most diverse families of earthworm species in India include Megascolecides 191 species (123 native) of 19 genera, Acanthodrilidae with 123 species (133 Native) of 26 genera and moniligastridae with 89 species (all native) of three genera. (Suthar, S., 2011)

Earthworm endemism is highly reported in India, with 71% of genera and 89% of species being endemic. At least 45 exotic species have been transported to India, primary belonging to union territories from other zoogeography realms. (Ghosh et al., 2022) India hosts a diverse and fascinating array of earthworm species and their presence is influenced by various ecological factors and human interactions. Understanding and conserving these soil dwelling organism are essential for maintain healthy ecosystem.

Regional status:

In Marathwada region, where agriculture plays a significant role, understanding the impact of pesticides on earthworm's habitat are crucial for sustainable practice and ecosystem health. The growth of earthworms recently exposed to pesticides has altered reproductive behavior and also affected growth. Extensive use of inorganic chemicals in agriculture and increased use of pesticides in soil through spray drifts, plant residues and soil application have increased soil pollution; exposure to such chemicals adversely affects earthworms at different life stages, including death, behavioral changes, growth reduction and reproduction (Chao et al, 2024).

Earthworms play a major role in recycling of organic waste, so earthworms are very familiar among the people of different country of the world including India. Nature of waste discharged, season, humidity, rainfall, temperature, soil type's earthworms distributed

3. Significance of the study:

The rearing of earthworms scientifically for composting organic wastes into valuable nutrients is known as vermin-technology. Charles Darwin describes earthworms as “unheralded soldiers of mankind and friend of farmers”. Darwin stated that “there may not be any other creature in the world that has played so important a role in the history of life on earth.

Aristotle stated that earthworm is the intestine of earth as it as it digests tons of soil. The earthworms swallow everything on their way, grind them in their gizzard, digest them in their intestine and absorb only 10 % of the swallowed materials. The remaining 90% is voided out as vermicasts. Vermicasts are described as black gold. They are used as valuable organic manure. Earthworms are god’s most gracious creatures as they are headless, eyeless, lung less, tubular cylinders; but they do miracle on the earth.

Earthworms are engineers of soil because of their effects on soil properties and their influence on the availability for other organisms, including microorganisms and plants. It is a play important role in an ecosystem. (SA Fall, 1990) The contribution of earthworms to plastic degradation and their capability to swallow smaller plastic fragments, known as micro plastics, has been emphasized. The worm physically changes the size of micro plastics and enhances microbial activities to increase the possibility of degradation. The majority of earthworm are decreasing that may be impact chemical reaction (Deiner K, et al., 2017) The survey of biodiversity on earth genomic revolution has fundamentally changed how. High-throughput sequencing platforms now enable the rapid sequencing of DNA from diverse kinds of environmental samples (termed "environmental DNA" or "eDNA"). Coupling HTS with our ability to associate sequences from eDNA with a taxonomic name is called "eDNA metabarcoding" and offers a powerful molecular tool capable of noninvasively surveying species richness from many ecosystems. (Lofty, 1977).Therefore research topic socially benefited to farmers and society and ecosystem.

4. Objectives:

- To study earthworm habits and habitat
- To analyze the species diversity of earthworm in the study area.
- To analyze the seasonal variation of species richness and density of a species in different habitat.
- To study factors effect on reproduction of earthworms in Natural habitat.
- To Study physicochemical properties of soil for analysis natural habitat.
- To Study impact of pesticide on earthworm natural Habitat.

5. Hypothesis:

Earthworm is an invertebrate animal of soil. They play a dynamic role conserve of biodiversity and ecosystem. Which factors effect and conserve the biodiversity and ecosystem? Earthworms are a major component of soil and these earthworms have been actively plowing the soil for millions of years and help to recycle organic nutrients for plant growth. So, conservation of earthworm population is precise crucial to maintain the soil ecology as well as soil health. Therefore research will also lead to conclusions about how to protect the natural habitat of earthworms. When farmers use pesticides on crop, the crop grows and develops well and these pesticides mix with the soil and its affect the soil and living organism that live in it. The effect of pesticides on soil will be shown in my research and this research topic will be beneficial to ecosystem and society.

6. Methodology completion of work :

- We are selected Seven district in Marathwada region such as Nanded, Parbhani, Hingoli, Jalana, Beed, Osmanabad, Aurangabad, Each district have to select three sampling site on the basis of geographically.
- Collection of earthworms and soli from selected site and take a photographs at sampling site. All the worms and soil carry into a carrying bag and brought to laboratory. These specimens clean and wash and preserved in 5% Formalin.
- Surveys will be conducted both during morning and afternoon hours of the day during fine weather conditions during which odonates are most active.
- Data collection for comparison of attributes among different habitat types
- Each selected habitat types were surveyed at least thrice during each season.
- Analysis of data with different software's BiodivR, PAST.
- Soil Samples collection from surface up to 25 cm depth for estimation of soli parameters. To analysis relationship between habitat and species.

Identification and determination:

The species will be identified with the help of various literatures and key. (Julka, 1988, Stephenson, 1923, Gates, 1972)

7. Facilities available regarding work at research center:

- Well-equipped Research laboratory
- Well established Zoological Museum.
- Well established chemicals And Glassware's
- There is an internet access to all for updating their knowledge and skills.
- The Research center has a collection of various research books
- Subscription of National and International journals

8. Year wise plan:

First Year:

- Visit the sites and observation of earth worm.
- Record the time and date of specimen collection.
- Preservation and identification of the specimens.
- Submission of progress report (6+6 months)

Second year:

- Visit the sites and observation of earth worm.
- Analyze seasonal variation of earth worm.
- Examine habitat of earth worm.
- Record the time and date of specimen collection.
- Preservation and identification of the specimens.
- Submission of progress report (6+6 months)

Third year:

- Annual report preparation.
- Participation in national and international conference and workshop.
- Final report writing.
- Data analysis and interpretation
- The mean proportionate abundance of each species will be found on three years of sampling period, is used for comparing their abundance.
- Presentation and submission of Pre-PhD Synopsis
- Final Ph.D. Thesis submission.

9. Research outcome:

Earthworm can act as bio indicators of soil quality in land because they rely on high quality soil for proper development in early life. Since their diet consist entirely of plant matter, living protozoa, nematodes, bacteria, and other microorganism's density is directly proportional to the population of prey and their abundance indicates the abundance of prey in the examined ecosystem. Earthworms have good species richness in a given habitat, This means that in a location such as soil, if one fined a wide variety of earthworm, then a similarly wide variety of plants should also be present, All these relationships can be studied with evidences with my research topic.

Earthworm is an invertebrate animal of soil. They play a dynamic role conserve of biodiversity and ecosystem. Which factors effect and conserve the biodiversity and ecosystem? Earthworms are a major component of soil and these earthworms have been actively plowing the soil for millions of years and help to recycle organic nutrients for plant growth. So, conservation of earthworm population is precise crucial to maintain the soil ecology as well as soil health.

In additional, earthworms are very sensitive to change the average temperature. Many species have moved to higher elevations and latitudes as global temperature rises and habitat dry out. Changes to the life cycle have been recorded with increase development of the instar stages and smaller adults body size as the average temperature increases. As the territory of many species stats to overlap, the rate hybridization of species that normally do not come in contact is increasing. If global climate change continues many members of earthworm will start to disappear. Therefore research will also lead to conclusions about how to protect the natural habitat of earthworms.

When farmers use pesticides on crop, the crop grows and develops well and these pesticides mix with the soil and its affect the soil and living organism that live in it. The effect of pesticides on soil will be shown in my research and this research topic will be beneficial to ecosystem and society.

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